REMARKS/ARGUMENTS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested. Claims 1, 3-4, 7-8, 10-30 are presently active in this case, Claims 1, 10, 27, and 28 amended by way of the present amendment.

In the outstanding Office Action, Claims 1, 3-4, 7-8, 10-23, and 27-30 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,545,245 to Yeh et al. in view of patent application serial no. 2004/0109263 to Suda et al. and U.S. Patent No. 7,041,608 to Sieber et al. or U.S. Patent No. 6,057,247 to Imai et al.; Claims 24-26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yeh et al. in view of Suda et al. and Sieber et al. or Imai et al.; and further in view of U.S. Patent No. 5,403,434 to Moslehi.

Turning now to the merits, in order to expedite issuance of a patent in this case, Applicants have amended independent Claims 1, 27 and 28 to clarify the patentable features of the present invention over the cited references. Specifically, Applicants' independent Claim 1, as amended recites a method of removing a fluorocarbon polymer chamber residue from a plasma processing system. The method includes introducing a process gas into a process chamber, the process gas consisting of CO, CO_2, or at least one of these molecules in combination with one or more of H_2, NH_2, H_2O, N_2 or an inert gas. Also recited is generating a plasma from the process gas, and exposing the fluorocarbon polymer chamber residue to the plasma in a waferless dry cleaning process to form a volatile reaction product from the residue, wherein a shield wafer is not provided on the substrate holder of the plasma processing system so that the substrate holder is cleaned by the waferless dry cleaning process. Finally, the claimed method recites exhausting the reaction product from the process chamber.

Thus, Applicants' independent Claim 1 has been amended to clarify that the process gas "consists" of CO, CO_2 or at least one of these in combination with other recited gases.

Independent Claims 27 and 28 have been similarly amended to include these features in system and means plus function claim format. As discussed in the Amendment filed July 19, 2007, Applicants' specification shows the benefits of eliminating O_2 from the process gas. Further, paragraph [0032] of Applicants' specification provides a list of preferred process gas molecules, which does not include O_2. Applicants independent claims previously recited that the process gas consists of a list of preferred molecules that excludes O_2, but Applicants have now further amended the claims to recite that the process gas consists of CO, CO_2 or at least one of these in combination with other listed gases. Thus, CO, CO_2 are the only oxygen containing molecules that can be included in the claimed process gas and at least one of CO, CO_2 must be included in the claimed process gas.

Use of CO or CO_2 in the process gas was previously recited in Claim 29. The outstanding Office Action admits that the primary reference to Yeh et al. does not disclose this feature but apparently cites Suda et al., Sieber et al., and Imai et al. as teaching the CO/CO_2 limitation now included in Claims 1, 27, and 28. The cited reference to Suda et al. discloses a process for manufacturing a magnetic head device. As seen in Figures 6A-6G of Suda et al. the process includes etching a substrate using a dry etch O_2 plasma. Suda also mentions that the dry etching steps for etching the substrate may be performed using "other gases that contain oxygen, such as CO, CO_2, NO, etc. that can generate oxygen plasma."[1] Thus, Suda et al. discloses a broad range of oxygen gases can be used to generate a plasma for etching a substrate device. However, there is no indication in Suda et al. that using CO and/or CO_2 in a plasma cleaning process for a semiconductor processing chamber provides any advantage over the broad range of possible gases including oxygen. In fact, Suda et al. does not disclose cleaning a process chamber at all. As discussed in Applicants' specification, the present inventors conducted experiments which led to the discovery that use

[1] Suda et al. at paragraph [0082].

of CO and/or CO_2 provide advantages for cleaning a process chamber. For example, Figures 5-7 of Applicants' specification show superior cleaning results from using a CO plasma. That is, of the many "oxygen containing gases" available, the present inventors discovered that CO and/or CO_2 provide unexpected results for cleaning a processing chamber. Suda et al. does not teach this feature.

The cited references to Sieber et al. and Imai et al. do not correct the deficiencies of Suda et al. Sieber et al. discloses a method of making an electronic device. As seen in Figure 2, the process includes creating an oxidizing plasma (step 24) to modify properties of the device electrode, and then depositing a fluorocarbon layer (step 26) on the electrode.[2] A post-deposition etch process can be used to remove fluorocarbon residue from the device before sealing and encapsulating the device. Sieber et al. further states that "plasmas containing oxygen process gas for cleaning the fluorocarbon residue may use plasmas containing oxygen or . . . use some combination of gases in the plasma such that fluorine is removed (e.g. in the form of HF) from the fluorocarbon and the remaining carbon-bearing materials oxidized to produce volatile species such as CO and CO_2."[3] Thus, like Suda et al., Sieber et al. discloses that an oxygen containing plasma can be used to process a substrate. While Sieber et al. mentions CO and CO_2, these are only byproducts of the substrate cleaning process and not used as the process gas itself.

Finally, the cited reference to Imai et al. discloses a method for controlling the environment inside a reaction chamber of a dry etching apparatus. As seen throughout Imai et al., undesirable fluorine is removed from the reaction chamber by generating oxygen plasma in the reaction chamber. In particular, column 19, lines 19-21, states, "carbon oxide and oxygen gases are introduced into the reaction chamber 107 at respective flow rates of 200 sccm or more and 80 sccm or more (in step S305)." Thus, Imai et al. does not disclose that

[2] Sieber et al. at col. 10, lines 29-45.
[3] Sieber et al. at col. 11, lines 10-20.

the process gas consists of CO, CO_2 or at least one of these in combination with other listed gases as recited in independent Claims 1, 27 and 28.

In addition, Claims 1, 27 and 28 recite that the exposing includes a waferless dry cleaning process where a shield wafer is not provided on a substrate holder of a plasma processing system so that the substrate holder is cleaned by the waferless dry cleaning process. As discussed in Applicants' specification, the claimed cleaning process allows improved cleaning of the substrate holder so that particulate contamination will not occur in processed wafers. As discussed in the July 19, 2007 response, Yeh et al. merely mentions the possibility of a waferless chamber conditioning process without any indication that this is advantageous. Further, as noted above the references to Suda et al. and Sieber et al. disclose processing of a substrate. Similarly, the reference to Imai et al. is primarily directed to cleaning a polymer film from a feature in a substrate (see for example Figures 1a-1d, 5a-5b, 9a-9d, and 24a-24d). That is, Suda et al., Sieber et al. and Imai et al. disclose processes wherein a wafer is present on the substrate holder. Based on this, Applicants respectfully submit that one of ordinary skill in the art would not select the merely mentioned waferless process of Yeh et al. and then modify this process using any of the process parameters of Suda et al., Sieber et al., or Imai et al. which are not waferless processes.

The cited references to Moslehi is cited for teachings within the dependent claims and do not correct the deficiencies of the primary references noted above. Therefore, for the reasons discussed above, Applicants' independent Claims 1, 27 and 28 patentably define over the cited references. As the remaining pending claims in this case depend from one of the independent claims distinguished above, these dependent claims also patentably define over the cited references.

Nevertheless, Applicants' Claims 29 and 30 further clarify the patentable distinctions of the present invention over the cited references. Specifically, Applicants' Claim 29

specifies that the process gas consists of CO, CO_2 or at least one of these molecules in combination with an inert gas. Claim 30 recites that the process gas consists of pure CO, or CO in combination with Argon. The prior art references do not disclose these features. As noted above, Figures 5-7 show the superior results provided by pure CO or CO in combination with Argon. Thus, Applicants' Claims 29-30 provide additional basis for patentability over the cited references.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application and the present application is believed to be in condition for formal allowance. An early and favorable action is therefore respectfully requested.

Respectfully submitted,

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